

Heights of rivers above zeros of gauges—Continued.

| Stations.                       | Distance to mouth of river. | Danger line on gauge. | Highest water. |                | Lowest water. |            | Mean stage.  | Monthly range. |
|---------------------------------|-----------------------------|-----------------------|----------------|----------------|---------------|------------|--------------|----------------|
|                                 |                             |                       | Height.        | Date.          | Height.       | Date.      |              |                |
| <i>Mississippi River—Cont'd</i> | <i>Miles.</i>               | <i>Feet.</i>          | <i>Feet.</i>   |                | <i>Feet.</i>  |            | <i>Feet.</i> | <i>Feet.</i>   |
| Greenville, Miss .....          | 595                         | 42                    | 11.7           | 31             | 8.8           | 15         | 10.3         | 2.9            |
| Vicksburg, Miss .....           | 474                         | 45                    | 12.3           | 22             | 9.5           | 16, 17     | 11.1         | 2.8            |
| New Orleans, La .....           | 108                         | 16                    | 5.9            | 3              | 3.7           | 31         | 4.6          | 2.2            |
| <i>Arkansas River.</i>          |                             |                       |                |                |               |            |              |                |
| Wichita, Kans .....             | 730                         | 10                    | 1.4            | 1              | 1.0           | 29-31      | 1.2          | 0.4            |
| Fort Smith, Ark .....           | 345                         | 22                    | 10.6           | 13             | 3.2           | 10         | 4.8          | 7.4            |
| Dardanelle, Ark .....           | 250                         | 21                    | 8.7            | 15             | 2.8           | 10         | 4.8          | 5.9            |
| Little Rock, Ark .....          | 170                         | 23                    | 9.7            | 16             | 4.8           | 12         | 6.8          | 4.9            |
| <i>White River.</i>             |                             |                       |                |                |               |            |              |                |
| Newport, Ark .....              | 150                         | 26                    | 14.4           | 23             | 8.2           | 19, 30, 31 | 10.9         | 6.2            |
| <i>Des Moines River.</i>        |                             |                       |                |                |               |            |              |                |
| Des Moines, Iowa .....          | 150                         | 19                    | 3.2            | 29-30          | 2.8           | 13-16      | 3.0          | 0.4            |
| <i>Illinois River.</i>          |                             |                       |                |                |               |            |              |                |
| Peoria, Ill. ....               | 135                         | 14                    | 8.0            | 31             | 4.7           | 17         | 5.5          | 3.3            |
| <i>Missouri River.</i>          |                             |                       |                |                |               |            |              |                |
| Bismarck, N. Dak. ....          | 1,201                       | 14                    | 2.8            | 13, 15         | 2.0           | 8-8        | 2.3          | 0.8            |
| Pierre, S. Dak. ....            | 1,006                       | 14                    | 2.8            | 19             | 2.2           | 11         | 2.5          | 0.6            |
| Sioux City, Iowa .....          | 876                         | 19                    | 5.8            | 31             | 5.0           | 16, 18     | 5.3          | 0.8            |
| Omaha, Nebr .....               | 561                         | 18                    | 7.0            | 1              | 6.4           | 19-23      | 6.6          | 0.6            |
| St. Joseph, Mo. ....            | 373                         | 10                    | 1.6            | 1, 2           | 0.8           | 23, 24, 28 | 1.1          | 0.8            |
| Kansas City, Mo. ....           | 280                         | 21                    | 7.6            | 19             | 5.2           | 16         | 6.3          | 2.4            |
| Boonville, Mo. ....             | 191                         | 20                    | 10.1           | 21             | 4.7           | 16         | 6.8          | 5.4            |
| Hermann, Mo. ....               | 95                          | 24                    | 10.2           | 22             | 4.2           | 16         | 6.5          | 6.0            |
| <i>Ohio River.</i>              |                             |                       |                |                |               |            |              |                |
| Pittsburg, Pa. ....             | 966                         | 22                    | 15.6           | 23             | 4.5           | 31         | 6.8          | 11.1           |
| Davis Island Dam, Pa. ....      | 960                         | 25                    | 14.6           | 23             | 2.0           | 6-8        | 5.1          | 12.6           |
| Wheeling, W. Va. ....           | 875                         | 36                    | 18.7           | 24             | 1.6           | 6-8        | 5.6          | 17.1           |
| Parkersburg, W. Va. ....        | 735                         | 36                    | 17.5           | 25             | 2.3           | 7          | 6.3          | 15.2           |
| Point Pleasant, W. Va. ....     | 703                         | 39                    | 21.2           | 25             | 1.8           | 2, 3       | 6.9          | 19.4           |
| Catlettsburg, Ky .....          | 651                         | 50                    | 24.5           | 26             | 1.0           | 3          | 8.2          | 23.5           |
| Portsmouth, Ohio .....          | 612                         | 50                    | 24.3           | 26             | 2.9           | 3, 4       | 9.0          | 21.4           |
| Cincinnati, Ohio .....          | 499                         | 50                    | 24.8           | 27             | 4.5           | 6          | 10.1         | 20.3           |
| Louisville, Ky .....            | 367                         | 23                    | 9.8            | 28             | 3.5           | 8          | 5.7          | 6.3            |
| Evansville, Ind .....           | 184                         | 35                    | 17.1           | 31             | 4.1           | 8          | 6.9          | 13.0           |
| Paducah, Ky .....               | 47                          | 40                    | 11.8           | 31             | 4.0           | 9          | 6.8          | 7.8            |
| <i>Allegheny River.</i>         |                             |                       |                |                |               |            |              |                |
| Warren, Pa. ....                | 177                         | 7                     | 5.2            | 24             | 0.0           | 1-21       | 1.0          | 5.2            |
| Oil City, Pa. ....              | 123                         | 13                    | 5.5            | 24             | 0.4           | 4-6        | 1.9          | 5.1            |
| Parkers Landing, Pa. ....       | 73                          | 20                    | 6.2            | 25             | 0.6           | 4, 5       | 2.0          | 5.6            |
| Freeport, Pa. ....              | 26                          | 20                    | 10.0           | 25             | 0.8           | 4-7        | 3.5          | 9.2            |
| <i>Conemaugh River.</i>         |                             |                       |                |                |               |            |              |                |
| Johnstown, Pa. ....             | 64                          | 7                     | 9.0            | 22             | 1.0           | 3-5        | 2.1          | 8.0            |
| <i>Red Bank Creek.</i>          |                             |                       |                |                |               |            |              |                |
| Brookville, Pa. ....            | 35                          | 8                     | 1.6            | 23             | 0.2           | 1-4        | 0.7          | 1.4            |
| <i>Beaver River.</i>            |                             |                       |                |                |               |            |              |                |
| Ellwood Junction, Pa. ....      | 10                          | 14                    | 1.9            | 23             | -1.2          | 13-18      | -0.3         | 3.1            |
| <i>Cumberland River.</i>        |                             |                       |                |                |               |            |              |                |
| Burnside, Ky .....              | 494                         | 50                    | 7.6            | 20             | 1.0           | 5          | 3.9          | 6.6            |
| Carthage, Tenn. ....            | 257                         | 30                    | 8.0            | 23             | 1.4           | 5          | 4.1          | 6.6            |
| Nashville, Tenn. ....           | 175                         | 40                    | 10.8           | 24             | 1.8           | 1, 2       | 5.6          | 9.0            |
| <i>Great Kanawha River.</i>     |                             |                       |                |                |               |            |              |                |
| Charleston, W. Va. ....         | 61                          | 30                    | 20.0           | 23             | 4.9           | 31         | 7.3          | 15.1           |
| <i>New River.</i>               |                             |                       |                |                |               |            |              |                |
| Hinton, W. Va. ....             | 95                          | 14                    | 8.3            | 23             | 1.6           | 1-4        | 3.1          | 6.7            |
| <i>Licking River.</i>           |                             |                       |                |                |               |            |              |                |
| Falmouth, Ky .....              | 30                          | 25                    | 4.8            | 24             | 0.9           | 1-4        | 2.3          | 3.9            |
| <i>Miami River.</i>             |                             |                       |                |                |               |            |              |                |
| Dayton, Ohio .....              | 69                          | 18                    | 2.0            | 21, 24, 25, 30 | 1.1           | 2, 3       | 1.6          | 0.9            |
| <i>Monongahela River.</i>       |                             |                       |                |                |               |            |              |                |
| Weston, W. Va. ....             | 161                         | 18                    | 6.3            | 22             | -1.2          | 8-6        | 0.4          | 7.5            |
| Fairmont, W. Va. ....           | 119                         | 25                    | 13.3           | 22             | 0.0           | 1-8        | 1.9          | 13.3           |
| Greensboro, Pa. ....            | 81                          | 18                    | 16.0           | 22             | 6.5           | 1-5        | 8.2          | 9.5            |
| Lock No. 4, Pa. ....            | 40                          | 28                    | 21.6           | 23             | 5.7           | 4-7        | 8.2          | 15.9           |
| <i>Cheat River.</i>             |                             |                       |                |                |               |            |              |                |
| Rowlesburg, W. Va. ....         | 36                          | 14                    | 7.0            | 22             | 0.6           | 3-6        | 2.3          | 6.4            |
| <i>Youghiogheny River.</i>      |                             |                       |                |                |               |            |              |                |
| Confluence, Pa. ....            | 59                          | 10                    | 6.0            | 23             | 0.5           | 3, 4       | 2.1          | 5.5            |
| West Newton, Pa. ....           | 15                          | 23                    | 10.2           | 23             | 0.1           | 2-7        | 1.4          | 10.1           |
| <i>Muskingum River.</i>         |                             |                       |                |                |               |            |              |                |
| Zanesville, Ohio. ....          | 70                          | 20                    | 10.2           | 24             | 6.6           | 5          | 7.4          | 3.6            |
| <i>Tennessee River.</i>         |                             |                       |                |                |               |            |              |                |
| Kingsport, Tenn. ....           | 534                         | 25                    | 6.5            | 6              | 1.0           | 2-3        | 3.5          | 5.5            |
| Chattanooga, Tenn. ....         | 430                         | 33                    | 17.6           | 7              | 3.2           | 3          | 7.2          | 14.4           |
| Bridgeport, Ala. ....           | 390                         | 24                    | 13.5           | 7              | 1.7           | 3, 4       | 5.1          | 11.8           |
| Florence, Ala. ....             | 220                         | 16                    | 9.9            | 9              | 1.5           | 6          | 4.4          | 8.4            |
| Johnsonville, Tenn. ....        | 94                          | 21                    | 12.2           | 11             | 2.6           | 7, 8       | 6.1          | 9.6            |

\*Distance to Gulf of Mexico. †Record for 30 days.

Heights of rivers above zeros of gauges—Continued.

| Stations.                     | Distance to mouth of river. | Danger line on gauge. | Highest water. |        | Lowest water. |             | Mean stage.  | Monthly range. |
|-------------------------------|-----------------------------|-----------------------|----------------|--------|---------------|-------------|--------------|----------------|
|                               |                             |                       | Height.        | Date.  | Height.       | Date.       |              |                |
| <i>Clinch River.</i>          | <i>Miles.</i>               | <i>Feet.</i>          | <i>Feet.</i>   |        | <i>Feet.</i>  |             | <i>Feet.</i> | <i>Feet.</i>   |
| Speers Ferry, Va. ....        | 156                         | 20                    | 2.8            | 23     | -0.6          | 2           | 0.1          | 3.4            |
| Clinton, Tenn. ....           | 46                          | 25                    | 7.0            | 25     | 2.4           | 4           | 4.6          | 4.6            |
| <i>Wabash River.</i>          |                             |                       |                |        |               |             |              |                |
| Mount Carmel, Ill. ....       | 50                          | 15                    | 5.1            | 26     | 2.1           | 11, 12      | 8.7          | 3.0            |
| <i>Red River.</i>             |                             |                       |                |        |               |             |              |                |
| Arthur City, Tex. ....        | 688                         | 27                    | 4.7            | 16-31  | 4.4           | 2-7         | 4.6          | 0.3            |
| Fulton, Ark. ....             | 565                         | 28                    | 5.4            | 10     | 2.7           | 6-8         | 3.6          | 2.7            |
| Shreveport, La. ....          | 449                         | 29                    | 2.2            | 14     | 0.6           | 10, 11      | 1.4          | 1.6            |
| Alexandria, La. ....          | 139                         | 33                    | 3.3            | 1-3    | -1.1          | 17          | 0.4          | 4.4            |
| <i>Atchafalaya Bayou.</i>     |                             |                       |                |        |               |             |              |                |
| Melville, La. ....            | 100*                        | 31                    | 15.3           | 1, 2   | 11.6          | 20          | 13.9         | 3.7            |
| <i>Ouachita River.</i>        |                             |                       |                |        |               |             |              |                |
| Camden, Ark. ....             | 340                         | 39                    | 12.1           | 23     | 3.8           | 4           | 6.3          | 8.3            |
| Monroe, La. ....              | 100                         | 40                    | 13.2           | 27     | 4.5           | 1           | 3.2          | 8.7            |
| <i>Yazoo River.</i>           |                             |                       |                |        |               |             |              |                |
| Yazoo City, Miss. ....        | 80                          | 25                    | 2.6            | 13     | 0.8           | 1, 2        | 1.5          | 2.3            |
| <i>Chattahoochee River.</i>   |                             |                       |                |        |               |             |              |                |
| Columbus, Ga. ....            | 140                         | 20                    | 26.4           | 4      | 2.5           | 31          | 7.9          | 23.9           |
| <i>Flint River.</i>           |                             |                       |                |        |               |             |              |                |
| Albany, Ga. ....              | 80                          | 20                    | 12.0           | 10, 11 | 0.8           | 1, 2        | 6.0          | 11.2           |
| <i>Cape Fear River.</i>       |                             |                       |                |        |               |             |              |                |
| Fayetteville, N. C. ....      | 100                         | 38                    | 10.0           | 23, 31 | 1.4           | 18          | 3.9          | 8.6            |
| <i>Columbia River.</i>        |                             |                       |                |        |               |             |              |                |
| Umatilla, Ore. ....           | 270                         | 25                    | 4.1            | 1      | 2.3           | 31          | 3.0          | 1.8            |
| The Dalles, Ore. ....         | 166                         | 40                    | 5.6            | 1      | 2.8           | 29-30       | 4.0          | 2.8            |
| <i>Willamette River.</i>      |                             |                       |                |        |               |             |              |                |
| Albany, Ore. ....             | 99                          | 20                    | 2.0            | 2      | 1.0           | 5-15, 20-31 | 1.1          | 1.0            |
| Portland, Ore. ....           | 10                          | 15                    | 3.9            | 3      | 0.7           | 25          | 2.3          | 3.2            |
| <i>Edisto River.</i>          |                             |                       |                |        |               |             |              |                |
| Edisto, S. C. ....            | 75                          | 6                     | 5.2            | 8, 9   | 2.7           | 1           | 3.9          | 2.5            |
| <i>James River.</i>           |                             |                       |                |        |               |             |              |                |
| Lynchburg, Va. ....           | 257                         | 18                    | 12.0           | 22     | 0.3           | 1, 2        | 2.4          | 11.7           |
| Richmond, Va. ....            | 110                         | 12                    | 11.7           | 24     | -0.1          | 1, 9        | 1.9          | 11.8           |
| <i>Alabama River.</i>         |                             |                       |                |        |               |             |              |                |
| Montgomery, Ala. ....         | 265                         | 35                    | 28.8           | 10     | 1.0           | 3           | 10.6         | 27.8           |
| Selma, Ala. ....              | 212                         | 35                    | 28.5           | 11     | 0.9           | 4, 5        | 11.7         | 27.6           |
| <i>Coosa River.</i>           |                             |                       |                |        |               |             |              |                |
| Rome, Ga. ....                | 225                         | 30                    | 23.8           | 6      | 2.0           | 1-3         | 6.8          | 21.8           |
| Gadsden, Ala. ....            | 144                         | 18                    | 22.0           | 8      | 0.7           | 3           | 8.0          | 21.3           |
| <i>Tombigbee River.</i>       |                             |                       |                |        |               |             |              |                |
| Columbus, Miss. ....          | 285                         | 33                    | 1.5            | 11     | -2.8          | 8, 31       | -1.3         | 4.3            |
| Demopolis, Ala. ....          | 155                         | 35                    | 3.5            | 14     | -2.2          | 3           | 0.4          | 5.7            |
| <i>Black Warrior River.</i>   |                             |                       |                |        |               |             |              |                |
| Tuscaloosa, Ala. ....         | 90                          | 38                    | 4.8            | 24     | -1.0          | 5           | 1.4          | 5.8            |
| <i>Pedee River.</i>           |                             |                       |                |        |               |             |              |                |
| Cheraw, S. C. ....            | 145                         | 27                    | 12.5           | 24     | 1.2           | 5           | 3.7          | 11.3           |
| <i>Black River.</i>           |                             |                       |                |        |               |             |              |                |
| Kingstree, S. C. ....         | 60                          | 12                    | 4.5            | 15     | 2.4           | 31          | 3.4          | 2.1            |
| <i>Lumber River.</i>          |                             |                       |                |        |               |             |              |                |
| Fairbluff, N. C. ....         | 10                          | 6                     | 2.6            | 19     | 1.0           | 4           | 1.6          | 1.6            |
| <i>Lynch Creek.</i>           |                             |                       |                |        |               |             |              |                |
| Effingham, S. C. ....         | 35                          | 12                    | 7.3            | 12     | 3.5           | 3           | 4.8          | 3.8            |
| <i>Potomac River.</i>         |                             |                       |                |        |               |             |              |                |
| Harpers Ferry, W. Va. ....    | 170                         | 16                    | 13.2           | 23     | 0.5           | 1, 2        | 2.7          | 12.7           |
| <i>Roanoke River.</i>         |                             |                       |                |        |               |             |              |                |
| Clarksburg, Va. ....          | 155                         | 12                    | 8.5            | 23     | -0.5          | 17-18       | 2.2          | 8.0            |
| <i>Sacramento River.</i>      |                             |                       |                |        |               |             |              |                |
| Red Bluff, Cal. ....          | 241                         | 23                    | -0.4           | 25     | -0.7          | 1, 18, 19   | -0.6         | 0.3            |
| Sacramento, Cal. ....         | 70                          | 25                    | 7.9            | 6, 7   | 7.5           | 1, 2, 18-24 | 7.3          | 0.4            |
| <i>Santee River.</i>          |                             |                       |                |        |               |             |              |                |
| St. Stephens, S. C. ....      | 50                          | 12                    | 8.6            | 7      | 7.2           | 23-25       | 7.9          | 1.4            |
| <i>Congaree River.</i>        |                             |                       |                |        |               |             |              |                |
| Columbia, S. C. ....          | 37                          | 15                    | 6.2            | 23     | 0.3           | 16-18       | 1.4          | 5.9            |
| <i>Wateree River.</i>         |                             |                       |                |        |               |             |              |                |
| Camden, S. C. ....            | 45                          | 24                    | 25.2           | 7      | 5.3           | 19          | 10.4         | 19.9           |
| <i>Savannah River.</i>        |                             |                       |                |        |               |             |              |                |
| Augusta, Ga. ....             | 130                         | 32                    | 24.0           | 6      | 7.1           | 2           | 11.5         | 16.9           |
| <i>Susquehanna River.</i>     |                             |                       |                |        |               |             |              |                |
| Wilkesbarre, Pa. ....         | 178                         | 14                    | 6.2            | 27     | 0.0           | 1-6         | 3.3          | 6.2            |
| Harrisburg, Pa. ....          | 70                          | 17                    | 8.3            | 24     | 0.7           | 3-7         | 3.3          | 7.6            |
| <i>Juniata River.</i>         |                             |                       |                |        |               |             |              |                |
| Huntingdon, Pa. ....          | 80                          | 24                    | 9.7            | 22     | 2.7           | 17, 18      | 3.8          | 7.0            |
| <i>W. Br. of Susquehanna.</i> |                             |                       |                |        |               |             |              |                |
| Williamsport, Pa. ....        | 35                          | 20                    | 9.0            | 23     | 0.5           | 2-4         | 2.6          | 8.5            |
| <i>Waccamaw River.</i>        |                             |                       |                |        |               |             |              |                |
| Conway, S. C. ....            | 40                          | 7                     | 3.4            | 3      | 2.0           | 17          | 2.6          | 1.4            |

## THE WEATHER OF THE MONTH.

By A. J. HENRY, Chief of Division of Records and Meteorological Data.

The statistical aspects of the weather of the month are presented in the tables which form the closing part of this REVIEW. Table I, in particular, contains numerous details that are important in the study of climatology. The numerical values in the tables have been generalized in a number of cases, the results appearing on Charts Nos. III to VIII, inclusive.

## PRESSURE AND WIND.

*Normal conditions.*—The geographic distribution of normal barometric readings at sea level and under local gravity for October is shown by Chart V of the MONTHLY WEATHER REVIEW for October, 1893.

In October normal pressure is highest over the South Atlantic and east Gulf States, Tennessee, the lower Ohio Valley, and the coast of Oregon, where it is 30.10 inches or more. It is

30.05 inches or more over a belt that extends from the Atlantic to the Pacific, and embraces over two-thirds of the United States. Normal pressure is lowest in the Saskatchewan and lower St. Lawrence valleys and over southern California and the lower Colorado Valley, where it is below 30.00 inches.

As compared with September, there is generally an increase in pressure in all districts. The greatest increase (0.10 inch or more) occurs over the lower Colorado Valley and the middle Plateau region.

In October the prevailing winds of the Atlantic coast from Virginia southward are southeasterly; those of the Gulf coast, lower Mississippi Valley, and southern Texas are easterly, while the winds of the plains from Kansas southward are southeasterly. The winds of New England are westerly or off-shore; those of the Lake region, upper Mississippi and Missouri valleys are from some westerly quarter. The winds of the Pacific coast and Plateau region are somewhat variable in October, although the dominant winds seem to be from a westerly quarter.

*The current month.*—The distribution of monthly mean pressure is shown on Chart IV. The configuration of the isobars is in general accord with normal conditions, but there are several important exceptions, viz, pressure over the lower St. Lawrence Valley and the Canadian Maritime Provinces was relatively high, 0.10 to 0.15 inch above normal; pressure was also relatively high over the central Rocky Mountain and Plateau regions, the upper Missouri Valley, and Assiniboia, 0.05 to 0.12 inch above normal; in fact, a winter type of pressure distribution prevailed over this entire region. Pressure was relatively low in the middle Mississippi Valley and over the upper Lakes, departures from average ranging from .01 to .08 inch.

As compared with September, 1898, pressure was higher in all districts. The increase was greatest in the central Rocky Mountain and Plateau regions, 0.15 to 0.24 inch, the normal increase being about half as much. There was also a marked increase on the Texas coast and over the Canadian Maritime Provinces.

The contrast between the weather of the current month and that of a year ago is very great. October, 1897, it will be remembered, was a month of unusual warmth and dryness, with but few storms of more than moderate severity. The current month, on the other hand, was particularly stormy in the central valleys and Lake region. There was an excess of rainfall and a deficiency of temperature over two-thirds of the country.

A tropical storm struck the coast of Florida in the vicinity of Jacksonville on the morning of the 2d and moved inland with greatly diminished force.

#### TEMPERATURE OF THE AIR.

*Normal conditions.*—The normal temperature of the air in the United States in October varies from about 78° at Key West, 70° at Jacksonville, 70° at New Orleans, 72° at Galveston, 63° at San Diego, to 47° at Eastport, 51° at Burlington, 50° at Buffalo, 51° at Detroit, 45° at Duluth, 40° at St. Vincent, 44° at Havre, 48° at Spokane, and 52° at Seattle, on Puget Sound. The warmest regions are the lower Rio Grande Valley and Florida; the coolest portion of the country is the region about Lake Superior.

In studying the distribution of monthly mean temperatures it will be found very helpful to consult the charts at the end of this REVIEW, especially No. VI, Surface Temperatures, Maximum, Minimum, and Mean. This chart gives a very good idea of the variations of temperature with latitude and longitude, and also of the distribution of normal surface temperatures. Chart VI for any month will differ from a normal chart merely in the displacement or bending of the

isotherms northward or southward according as the temperature of the particular locality is above or below the normal for the place and season.

*The current month.*—The month was characterized by a relatively large number of alternating warm and cool periods, abrupt and unseasonable temperature changes, and by the prevalence of relatively low temperature over the northern and Middle Rocky Mountain and Plateau regions, over which, as has been already stated, a winter type of pressure distribution also prevailed.

The month opened with high temperature for the season from Texas northeastward to the Lake region and New England. Temperature fell over the Plateau region on the morning of the 3d, and remained below the seasonal average for a number of days; small offshoots from the permanent cold area thus developed moved eastward to the St. Lawrence Valley by way of the Lake region from the 3d to the 5th, and again from the 6th to the 8th. More severe cool waves moved southeastward to the Mississippi Valley, whence they curved to the east and northeast on the 13-15th; 16-19th; 20th-23d, and 25-28th. The minimum temperature of the month was generally recorded during the last-named period, although killing frost and freezing temperatures occurred in the lower Mississippi Valley during the cool wave of the 22d. The following special bulletin with reference to frost in yellow fever districts was issued by the Central Office, October 22, 1898.

#### FROSTS IN YELLOW FEVER DISTRICTS.

Telegraphic reports of this morning show that frosts generally occurred throughout the infected districts. In Alabama, eastern and northern Mississippi, and northern Louisiana the frosts were heavy and killing; in southwestern Mississippi and southern Louisiana light frost was reported. At Mobile the minimum temperature was 40° and at New Orleans 46°, the lowest previous record for the third decade of October being 34° at Mobile and 42° at New Orleans. November 18 is the earliest date on which freezing temperature has ever occurred at New Orleans, and November 2 is the earliest date of freezing temperature at Mobile.

In central Mississippi and northern Louisiana, and also in northern Alabama and northern Georgia, freezing weather has occurred in the third decade of October. The earliest date of heavy frost at Mobile was November 2, 1874, and 1878, respectively. The earliest date of heavy frost at New Orleans was November 11, 1877.

The first heavy frost has occurred as late as December 29 at Mobile, while at New Orleans November and December have in a number of years failed to show the occurrence of heavy frost. The average date of first heavy frost is November 22 at Mobile and December 7 at New Orleans.

The average minimum temperatures for the region referred to range from 50° to 55° during November, with occasional periods of freezing temperature.

The occurrence of light frost Tuesday morning supplemented by heavier frosts and lower temperature this morning (October 22) may be considered unfavorable for the further progress of the disease. Present conditions indicate frost, and temperature 40°, or slightly below, to-night in Alabama, Mississippi, and in the interior of Louisiana. The temperature will probably remain for several days below the seasonal average, which is 66° at New Orleans and 65° at Mobile.

The limit of freezing weather for the current month, shown on Chart VI, is from 8° to 10° farther south than it was in October, 1897. The lowest temperature registered by standard instruments was 2° below zero in central Montana and also in South Dakota.

The highest maximum temperatures, 100° and over, were registered in the interior of southern Texas and also in southern California and Arizona. The maximum temperatures during the warm period of the 3d-4th were higher than ever before recorded for the season by from 3° to 4° at Buffalo, N. Y., and Eastport, Me.

The distribution of the observed monthly mean temperature of the air is shown by red lines (isotherms) on Chart VI. This chart also shows the maximum and the minimum temperatures, the former by black and the latter by dotted lines. As will be noticed, these lines have been drawn over the Rocky Mountain Plateau region, although the temperatures

have not been reduced to sea level; the isotherms relate, therefore, to the average surface of the country in the neighborhood of the various observers, and as such must differ greatly from the sea-level isotherms of Chart IV.

The average temperatures of the respective geographic districts, the departures from the normal of the current month and from the general mean since the first of the year, are presented in the table below for convenience of reference:

*Average temperatures and departures from the normal.*

| Districts.                      | Number of stations. | Average temperatures for the current month. | Departures for the current month. | Accumulated departures since January 1. | Average departures since January 1. |
|---------------------------------|---------------------|---|-----------------------------------|---|-------------------------------------|
|                                 |                     | °   | °                                 | °                                       | °                                   |
| New England .....               | 10                  | 52.9  | + 2.0                             | +14.1                                   | + 1.4                               |
| Middle Atlantic .....           | 12                  | 57.9  | + 2.1                             | +17.5                                   | + 1.8                               |
| South Atlantic .....            | 10                  | 65.4  | + 1.3                             | +10.7                                   | + 1.1                               |
| Florida Peninsula .....         | 7                   | 72.9  | + 0.0                             | + 3.2                                   | + 0.4                               |
| East Gulf .....                 | 7                   | 65.4  | - 2.0                             | + 3.3                                   | + 0.3                               |
| West Gulf .....                 | 7                   | 66.7  | - 0.4                             | +13.2                                   | + 1.3                               |
| Ohio Valley and Tennessee ..... | 12                  | 57.1  | + 2.0                             | +19.0                                   | + 1.9                               |
| Lower Lake .....                | 8                   | 53.3  | + 2.0                             | +27.6                                   | + 2.6                               |
| Upper Lake .....                | 7                   | 47.8  | + 0.7                             | -28.0                                   | - 2.6                               |
| North Dakota .....              | 11                  | 38.8  | - 3.6                             | +20.2                                   | + 2.0                               |
| Upper Mississippi .....         | 11                  | 50.7  | - 2.0                             | +19.6                                   | + 2.0                               |
| Missouri Valley .....           | 10                  | 49.6  | - 3.2                             | +20.3                                   | + 2.0                               |
| Northern Slope .....            | 7                   | 41.6  | - 4.6                             | + 6.0                                   | + 0.6                               |
| Middle Slope .....              | 6                   | 53.6  | - 1.7                             | + 3.6                                   | + 1.0                               |
| Southern Slope .....            | 5                   | 60.7  | - 0.6                             | + 5.2                                   | + 0.5                               |
| Southern Plateau .....          | 13                  | 59.8  | - 0.3                             | + 0.8                                   | + 0.1                               |
| Middle Plateau .....            | 9                   | 47.0  | - 3.1                             | - 6.5                                   | - 0.6                               |
| Northern Plateau .....          | 11                  | 46.3  | - 2.8                             | + 5.9                                   | + 0.6                               |
| North Pacific .....             | 9                   | 51.2  | - 0.2                             | + 9.1                                   | + 0.9                               |
| Middle Pacific .....            | 5                   | 59.9  | + 1.5                             | - 4.4                                   | - 0.4                               |
| South Pacific .....             | 4                   | 64.0  | + 0.6                             | + 3.9                                   | + 0.4                               |

*In Canada.*—Prof. R. F. Stupart says:

The temperature was below average from the coast line of British Columbia east to the eastern borders of Manitoba, and above average elsewhere throughout Canada. The deficiency was very marked in the Northwest Territories, where the amount below average was from 5° to 6° over a very large portion of the country. Ontario was again much above average, the amount being particularly marked in the lower Lake region. This makes the fourteenth consecutive month in which the temperature has been above average in the lower Lake region.

#### FROST.

Summarized from reports of climate and crop section directors:

*Alabama.*—First of season: Northern district, light from 13th to 15th; heavy, 15th and 16th; killing, 18th, 20th, 22d or 23d. Southern district, light, 15th or 18th; heavy, 22d; killing, except in extreme southern counties, 22d. Mobile, first light, 18th; first heavy, 22d; no killing reported. Montgomery, first heavy, 22d; first killing, 23d. The killing frost occurred this year from two to four weeks earlier than in 1897 and considerably earlier than the average.

*Arizona.*—Killing frost, Calabasas, 17th; Empire Ranch, 19th; Music Mountain, 2d, 21st, 26th, and at Strawberry, 5th.

*Arkansas.*—Killing frost on the 18th, 19th, 21st, 22d, 23d, and 25th to 31st.

*California.*—Killing frost occurred at Malakoff Mine, North San Juan, and Pilot Creek on the 1st; Rosewood and Summerdale on the 4th; at Descanso on the 4th, 8th, 19th, 27th, and 28th; Susanville, 1st, 5th, 16th, 19th.

*Connecticut.*—Killing frost occurred on the 10th, 13th, 17th, 18th, 27th, 28th, and 31st.

*Delaware.*—Killing frost 28th.

*District of Columbia.*—First killing frost on the 24th.

*Florida.*—Light frost occurred at Jacksonville, 23d; Gainesville, 26th.

*Georgia.*—Killing frost on the 15th, 19th, 21st, 22d, 23d, 24th, 25th, 26th; nineteen places on the 27th, 28th.

*Illinois.*—Killing frost 12th to 15th, 23d, 26th to 31st.

*Indiana.*—Killing frost occurred on the 14th, 15th, 20th, 23d, 26th to 31st.

*Kentucky.*—Killing frost on the 15th, 18th, 22d, 23d, 26th, and 27th.

*Louisiana.*—Killing frost occurred from the 18th to 24th and 26th to 31st.

*Mississippi.*—Killing frost on the 18th, 22d, 23d, 26th, 27th, and 28th.

*Missouri.*—The first killing frost of the season occurred in scattered localities on the morning of the 14th, but there was no general killing frost until the last decade of the month.

*North Carolina.*—The earliest killing frost occurred on the 15th, and generally on the 16th in the west, 24th, 27th, and especially the 28th.

*Oklahoma.*—Killing frost occurred on the 19th to 22d, 26th, 28th, 30th, 31st.

*South Carolina.*—Killing frost on the 15th, 16th, 19th, 22d to 25th, 27th, 28th, 31st.

*Tennessee.*—Killing frosts were reported generally throughout the State from the 15th to 23d, and freezing weather about these dates.

*Texas.*—Killing frost occurred on the 17th, 18th, 20th, 21st, 22d, 24th to 29th.

*Virginia.*—Killing frost on the 15th, 16th, 17th, 19th, 20th, and 23d to 31st.

*West Virginia.*—Killing frost occurred on the 15th, 16th, 17th, 19th, 20th, 24th to 31st.

#### PRECIPITATION.

*Normal conditions.*—Heavy rains in October (4 to 6 inches and over), occur on the South Atlantic, Florida and Gulf coasts, over limited areas in New England, and on the coasts of Washington and Oregon. Isolated areas or islands of heavy rains will also be found in southeastern Missouri and portions of Arkansas and Louisiana. The normal rainfall east of the one hundredth meridian, excluding the territory above described, is from 2 to 3 inches. On the Pacific coast the area of 2-inch rains has reached the coast line of northern California; the greater portion of the State, however, receives less than an inch of rainfall. Between the one hundredth and one hundred and twenty-second meridians the precipitation of October is light in quantity and variable in distribution.

*Current month.*—The precipitation of the current month was above the normal over about two-thirds of the United States. There were small areas in the South Atlantic and Gulf States where less than the normal amount of rain fell, but elsewhere east of the ninety-fifth meridian and generally over Montana, Wyoming, and the Dakotas, the fall exceeded the normal amount by from 1 to 4 inches. In extreme cases, as in southern Florida, northern Georgia, western North Carolina, as also on the coast of the same State and over the delta of the Mississippi, the excess ranged from 6 to 10 inches. The precipitation east of the Rocky Mountains has not been so abundant since 1890. The precipitation on the Pacific coast fell short of the normal amount, except on the southern shore of the Strait of Fuca, notwithstanding the good beginning made in September. In Arizona, with the exception of a trace at Flagstaff and Strawberry, no rain has fallen since September 11.

*Average precipitation and departures from the normal.*

| Districts.                      | Number of stations. | Average.       |                       | Departure.     |                           |
|---------------------------------|---------------------|----------------|-----------------------|----------------|---------------------------|
|                                 |                     | Current month. | Percentage of normal. | Current month. | Accumulated since Jan. 1. |
|                                 |                     | Inches.        |                       | Inches.        | Inches.                   |
| New England .....               | 10                  | 6.52           | 162                   | +2.50          | + 4.60                    |
| Middle Atlantic .....           | 12                  | 5.14           | 164                   | +2.00          | - 0.90                    |
| South Atlantic .....            | 10                  | 5.47           | 198                   | +1.50          | - 6.80                    |
| Florida Peninsula .....         | 7                   | 8.93           | 185                   | +4.10          | - 6.50                    |
| East Gulf .....                 | 7                   | 5.15           | 175                   | +2.20          | + 0.80                    |
| West Gulf .....                 | 7                   | 2.32           | 82                    | -0.50          | - 3.40                    |
| Ohio Valley and Tennessee ..... | 12                  | 3.65           | 198                   | +1.00          | + 2.20                    |
| Lower Lake .....                | 8                   | 4.14           | 196                   | +1.10          | + 0.30                    |
| Upper Lake .....                | 7                   | 3.99           | 193                   | +1.00          | - 0.50                    |
| North Dakota .....              | 7                   | 2.66           | 182                   | +1.20          | - 0.30                    |
| Upper Mississippi .....         | 11                  | 4.43           | 175                   | +1.90          | + 6.50                    |
| Missouri Valley .....           | 10                  | 2.23           | 116                   | +0.30          | + 3.50                    |
| Northern Slope .....            | 7                   | 1.15           | 195                   | +0.30          | - 0.20                    |
| Middle Slope .....              | 6                   | 1.36           | 100                   | 0.00           | + 2.30                    |
| Southern Slope .....            | 6                   | 0.84           | 41                    | -1.20          | - 2.90                    |
| Southern Plateau .....          | 13                  | 0.06           | 8                     | -0.60          | - 2.40                    |
| Middle Plateau .....            | 9                   | 0.57           | 74                    | -0.20          | - 1.90                    |
| Northern Plateau .....          | 11                  | 0.65           | 51                    | -0.60          | - 3.30                    |
| North Pacific .....             | 9                   | 4.07           | 77                    | -1.20          | - 6.60                    |
| Middle Pacific .....            | 5                   | 1.07           | 64                    | -0.60          | - 8.70                    |
| South Pacific .....             | 4                   | 0.13           | 21                    | -0.50          | - 5.40                    |

The geographic distribution of precipitation is shown on Chart III, and the numerical values for about 3,000 stations appear in Tables II and III, while the details as to excessive rains will be found in Table XI.

*In Canada.*—Professor Stupart says:

In the extreme northeastern portion of Quebec and in the eastern portion of Nova Scotia the rainfall was a little below the average, but in all the large remaining portions of Canada it was above the average, noticeably so in the lower Lake region, the Ottawa Valley, and the Bay of Fundy district. On the Island of Grand Manan the fall was 5.0 inches above the average; at St. John, 3.9 inches above, and at Fredericton 3.6 inches above. In other portions of the Dominion the large amounts in excess of the average were Winnipeg, 4.1 inches above; Ottawa, 3.2 inches above; and Toronto, 3.1 inches above. At the end of the month Prince Albert reported 1.0 inch of snow on the ground and Battleford a trace. Between the 14th and 15th instants a heavy fall of snow occurred in parts of northeastern Ontario, as well as in portions of Quebec and the Maritime Provinces, and for several days afterwards snow to the depth of several inches lay in the woods in the localities where it had occurred.

## SNOWFALL.

The total snowfall for the current month is given in Tables I and II, and its geographic distribution is shown on Chart VIII. The total depth of snow was greatest in the mountain regions of California, Colorado, Idaho, Montana, and Wyoming. There were also smaller areas of heavy snow in South Dakota and northern Nebraska. Practically no snow fell south and east of a line drawn from Springfield, Mo., to Saginaw Bay, Mich.

## SNOWSTORM OF OCTOBER 17-18, 1898.

A severe snowstorm prevailed throughout northeastern Kansas, eastern Nebraska, South Dakota, northeastern Missouri, and western Iowa on the 17th and 18th. Moist heavy snow began falling in Kansas about 3 a. m. of the 17th and continued during the greater part of the day. Snow began in eastern Nebraska about 6 a. m. and continued during the day, being accompanied by northwest winds varying from 25 to 35 miles per hour, and temperature about freezing. Snow began falling at Yankton, S. Dak., at 11:50 a. m. of the 17th, and continued until 9:20 p. m. of the 18th, the total fall being 12.2 inches. As at other places the snow was accompanied by high northwest winds and temperature about freezing. Snow fell to the northward as far as Bismarck, but the fall did not extend to the eastward as far as St. Paul, Minn., or Des Moines, Iowa. Notwithstanding the fact that in Kansas, Missouri, and southern Nebraska the snow melted almost as fast as it fell, there were from 2 to 6 inches on the ground at 8 p. m. of the 17th. The greatest fall as determined by the depth of unmelted snow lying on the ground, occurred in and around Yankton, S. Dak., and over a narrow strip of territory extending about 50 miles southward. We are indebted to Mr. F. C. Hills, Receiver of the Sioux City, O'Neill and Western Railway Company, for a statement of depth of snow at the various stations on that line between Sioux City, the eastern terminus, and O'Neill, 130 miles to the westward. In the statement below the stations are given in order from east to west, and there is a sufficient number of them to form a fairly accurate cross-section of the storm.

|                        | Inches.  |
|------------------------|----------|
| South Sioux City ..... | 3        |
| Jackson.....           | 3        |
| Goodwin.....           | 4        |
| Waterbury.....         | 4        |
| Allen.....             | 6 or 7   |
| Dixon.....             | 6 or 7   |
| Laurel.....            | 8        |
| Belden.....            | 12       |
| Randolph.....          | 12 or 14 |
| Osmond.....            | 12       |
| Plainview.....         | 10 to 12 |
| Brunswick.....         | 8        |
| Savage.....            | 4 or 5   |
| Orchard.....           | 3 or 4   |
| Page.....              | 3 or 4   |
| O'Neill.....           | 3        |

## Mr. Hills remarks:

In opening the blockade we found very heavy snow drifts in the cuts, viz, from 8 to 16 feet deep between Randolph and Osmond, and from 3 to 10 feet between other stations. We have never had anything like it at this time of the year. The snow was very hard to handle, being wet and heavy; it would push ahead of the plow instead of sliding off and passing out of cuts.

Traffic on railways and street car lines was delayed, and telephone wires were generally prostrated throughout the storm area, causing much inconvenience, but little really serious damage.

The suddenness and severity of the storm were quite out of the ordinary, though not wholly unprecedented. The trees had not yet shed their foliage; some of the hardier flowers were still in bloom, and the usual time of severe snowstorms was at least a month distant. Once before, viz, on October 15, 1880, a wind and snow storm, of equal if not greater severity, swept over the same region and passed onward to the Great Lakes. The loss of life and destruction of property on the latter were far greater than have since been recorded. Happily, in the present case, the storm had greatly abated when it reached the Lake region.

## HAIL.

The following are the dates on which hail fell in the respective States:

California, 7, 8, 14, 22, 30. Colorado, 8. Idaho, 14, 15. Indian Territory, 10. Kansas, 7. Kentucky, 9. Maine, 31. Michigan, 5, 26. Minnesota, 1. Mississippi, 20. Missouri, 11, 15, 24. Nebraska, 9. New Hampshire, 12. New Jersey, 15. New Mexico, 6, 7, 8. New York, 17, 24, 26, 29. North Dakota, 1. Texas, 10, 16, 19, 20. Utah, 1.

## SLEET.

The following are the dates on which sleet fell in the respective States:

Arkansas, 17, 19, 20, 21, 23, 25. California, 8, 31. Colorado, 15. Illinois, 18, 25. Indiana, 17, 20. Indian Territory, 19. Iowa, 17, 18, 20, 25. Kansas, 19, 24. Kentucky, 26. Michigan, 12, 13, 19, 24, 25. Minnesota, 4, 5, 12, 16, 17, 18, 19. Missouri, 17, 18, 19, 20, 25. Montana, 14, 18. Nebraska, 17, 18, 19. New Hampshire, 31. New York, 31. North Dakota, 2, 4, 17, 19, 23, 31. Ohio, 21, 22, 25, 26, 27. Oklahoma, 19. Pennsylvania, 26, 27, 28. South Dakota, 17, 24. Tennessee, 21, 22, 23, 26. Utah, 1. Washington, 2, 11, 13. West Virginia, 15. Wisconsin, 25. Wyoming, 15, 24.

## HUMIDITY.

The humidity observations of the Weather Bureau are divided into two series; the first or tridaily series began in 1871 and ended with 1887; the second or twice-daily series is continuous from 1888 to the present time.

The monthly means of the second or present series are based upon observations of the whirled psychrometer at 8 a. m. and 8 p. m., seventy-fifth meridian time, which corresponds to 5 a. m. and 5 p. m., Pacific; 6 a. m. and 6 p. m., Mountain; and 7 a. m. and 7 p. m., Central standard time.

Mean values computed from the first series are naturally not directly comparable with those of the second. In general the means of the first series are lower than those of the second, since they include an observation in the afternoon when the relative humidity of the air is near the minimum of the day. At stations in the western plateau region, however, the converse holds good, the means of the second series being lower than those of the first by amounts ranging from 0 to 10 per cent on the average of the year.

In the present state of knowledge respecting the diurnal

variation in the moisture of the air, we are scarcely warranted in combining the two series in a general mean.

*The current month.*—A high percentage of humidity prevailed in the majority of districts as shown by the table below.

The districts of high humidity were North Dakota, the upper Mississippi Valley, and the Ohio Valley and Tennessee. The districts of low humidity were the southern plateau, southern slope, and the Pacific coast. The highest monthly mean humidity at a single station in the United States was 88 per cent at Alpena. The monthly mean humidity at the four stations of the West Indian service, from which complete reports were received, was as follows: Curaçoa, 78 per cent; Basseterre, 79 per cent; Bridgeton, 88 per cent; Colon, 90 per cent. The lowest monthly mean humidity at a single station was 20 per cent at Independence, Cal., at which point no rain fell during the month, and there was less than 10 per cent of cloudiness.

In general, there was fair agreement between the relative humidity and cloudiness on the one hand, and the rainfall on the other, although exceptions were not lacking; thus, in the east Gulf States humidity was 5 per cent above normal, and cloudiness 5 per cent below, and rainfall 23 per cent above.

*Average relative humidity and departures from the normal.*

| Districts.                   | Average. | Departure from the normal. | Districts.                 | Average. | Departure from the normal. |
|------------------------------|----------|----------------------------|----------------------------|----------|----------------------------|
| New England .....            | 78       | + 5                        | Missouri Valley .....      | 70       | + 5                        |
| Middle Atlantic .....        | 73       | + 5                        | Northern Slope .....       | 60       | + 2                        |
| South Atlantic .....         | 73       | + 3                        | Middle Slope .....         | 58       | 0                          |
| Florida Peninsula .....      | 72       | + 2                        | Southern Slope .....       | 51       | - 11                       |
| East Gulf .....              | 77       | + 5                        | Southern Plateau .....     | 27       | - 21                       |
| West Gulf .....              | 73       | + 1                        | Middle Plateau .....       | 50       | + 5                        |
| Ohio Valley and Tennessee.   | 73       | + 9                        | Northern Plateau .....     | 63       | + 1                        |
| Lower Lake .....             | 73       | + 3                        | North Pacific Coast .....  | 73       | - 16                       |
| Upper Lake .....             | 82       | + 5                        | Middle Pacific Coast ..... | 64       | - 7                        |
| North Dakota .....           | 80       | + 10                       | South Pacific Coast .....  | 66       | - 3                        |
| Upper Mississippi Valley.... | 78       | + 8                        |                            |          |                            |

In using the table by means of which the amount of moisture in the air is computed from the readings of the wet and dry bulb thermometers, the pressure argument has almost always been neglected, an omission that has little significance except for low temperatures and at high stations, such as Santa Fe, El Paso, Cheyenne, and a few others. The failure to apply a correction for the influence of pressure on the evaporation and therefore on the temperature of the wet-bulb thermometer has had the effect of making the monthly means of relative humidity at high-level stations too small by quantities ranging from 5 to 10 per cent. In the application of the monthly averages of the above table, or those of individual stations in Table I, to special inquiries, whether in the departments of biology, climatology, or sanitary science, this fact should be kept in mind. It should also be remembered that the hours at which observations in the Rocky Mountain Plateau region are made, viz, at 5 or 6 local mean time, morning and afternoon, give approximately the maximum and minimum values of the relative humidity for the day; probably the means of such hours approach more nearly the true mean of the month than is the case on the Atlantic seaboard and in the seventy-fifth meridian time belt.

### WIND.

The maximum wind velocity at each Weather Bureau station for a period of five minutes is given in Table I, which also gives the altitude of Weather Bureau anemometers above ground.

Following are the velocities of 50 miles and over per hour registered during the month:

REV—2

### Maximum wind velocities.

| Stations.              | Date. | Velocity. | Direction. | Stations.              | Date. | Velocity. | Direction. |
|------------------------|-------|-----------|------------|------------------------|-------|-----------|------------|
| Amarillo, Tex .....    | 15    | 60        | sw.        | Fort Canby, Wash.....  | 8     | 58        | se.        |
| Buffalo, N. Y. ....    | 11    | 51        | w.         | Do .....               | 13    | 54        | se.        |
| Do .....               | 23    | 56        | sw.        | Do .....               | 14    | 56        | se.        |
| Cape May, N. J. ....   | 18    | 60        | e.         | Huron, S. D. ....      | 1     | 56        | s.         |
| Charleston, S. C. .... | 2     | 62        | e.         | Jacksonville, Fla..... | 2     | 60        | w.         |
| Chicago, Ill. ....     | 17    | 63        | se.        | New York, N. Y. ....   | 23    | 52        | ne.        |
| Cleveland, Ohio .....  | 27    | 50        | w.         | Savannah, Ga. ....     | 2     | 60        | ne.        |
| Eastport, Me. ....     | 15    | 60        | e.         | Sioux City, Iowa ..... | 9     | 50        | s.         |
| El Paso, Tex. ....     | 19    | 51        | ne.        | Woods Hole, Mass ..... | 26    | 51        | se.        |
| Fort Canby, Wash.....  | 1     | 50        | se.        | Yankton, S. D. ....    | 9     | 55        | s.         |

### LOCAL STORMS AND TORNADOES.

The winds of the month were rather more boisterous than usual, especially in the Lake region, although no remarkably high velocities were reported. Vessel interests suffered heavy loss, especially during the thick weather on the 26–27th. Heavy financial loss was also experienced on the Florida coast about Fernandina and inland some distance, during the prevalence of the tropical hurricane on the 2d. The damage to crops by rain in the latter case was much greater than by wind.

The usual details follow:

3d. A newspaper report from Stockton, Cal., states that a small tornado, moving toward the southeast, struck the northeastern part of that city about 12:30 p. m. The damage to roofs, outhouses, and windmills, aggregated about \$1,200. The path of the storm was from 50 to 100 feet wide. The testimony regarding the character of the storm, if submitted from any locality subject to tornadoes, would be accepted as sufficient warrant for classing the storm as a true tornado. Owing to the rarity of tornadoes on the Pacific coast, however, further information concerning the storm is awaited with interest.

4th. A veritable tornado, having its origin near the line of Floyd and Bartow counties, Ga., about one and a half miles southwest of lot No. 118, moved northeastward for a distance of about 15 miles. But little damage was done, except to timber, the loss to buildings not exceeding \$150. No lives were lost.

9th. A severe windstorm passed over the southwestern portion of Moody County, S. Dak., about 8:15 p. m., Central time. A careful estimate of the damage to buildings, bridges, and farm property places the amount of loss at \$8,000. Mr. G. A. Perley, voluntary observer at Flandreau, who witnessed the storm, notes that the distribution of the debris indicates a rolling motion around a horizontal axis rather than a gyratory motion around a vertical axis.

Destructive windstorms frequently occur between the Mississippi River and the eastern foothills of the Rocky Mountains, in which the chief characteristics of a tornado, viz, a pendant funnel cloud and violent gyratory motion, are missing. Hinrichs has described such storms in a general way under the name *Derecho*. More observations, especially of the apparent altitude, form, and general appearance of the storm cloud, are needed.

21st. A severe windstorm swept over portions of southern Texas on the early morning of this date. The loss of one life was reported from Deepark, and the winds were of sufficient violence to wreck buildings at Pasadena and overturn freight cars at Missouri, Tex.

### SUNSHINE AND CLOUDINESS.

The quantity of sunshine, and therefore of heat, received by the atmosphere as a whole is very nearly constant from year to year, but the proportion received by the surface of the earth depends upon the absorption by the atmosphere,

and varies largely with the distribution of cloudiness. The sunshine is now recorded automatically at 21 regular stations of the Weather Bureau by its photographic and at 47 by its thermal effects. The photographic record sheets show the apparent solar time, but the thermometric records show seventy-fifth meridian time; for convenience the results are all given in Table IX for each hour of local mean time. In order to complete the record of the duration of cloudiness these registers are supplemented by special personal observations of the state of the sky near the sun for an hour after sunrise and before sunset, and the cloudiness for these hours has been added as a correction to the instrumental records, whence there results a complete record of the duration of sunshine from sunrise to sunset.

The average cloudiness of the whole sky is determined by numerous personal observations at all stations during the daytime, and is given in the column "average cloudiness" in Table I; its complement, or percentage of clear sky, is given in the last column of Table IX for the stations at which instrumental self-registers are maintained.

The percentage of clear sky (sunshine) for all of the stations included in Table I, obtained as described in the preceding paragraph, is graphically shown on Chart VII. The regions of cloudy and overcast skies are shown by heavy shading; an absence of shading indicates, of course, the prevalence of clear, sunshiny weather.

The formation of fog and cloud is primarily due to differences of temperature in a relatively thin layer of air next to the earth's surface. The relative position of land and water surfaces often greatly increases the tendency to form areas of cloud and fog. This principle is perhaps better exemplified in the Lake region than elsewhere, although it is of quite general application. The percentage of sunshine on the lee shores of the Lakes is always much less than on the windward shores. Next to the permanent influences that tend to form fog and cloud may be classed the frequency of the passage of cyclonic areas.

*The current month.*—The geographic distribution of sunshine and, conversely, of cloudiness, is shown on Chart VII. The cloudiness of the upper Mississippi Valley, Missouri Valley, North Dakota, and the Lake region was excessive, due largely to the frequency of cyclonic storms. In general the cloudiness was greater than usual although a notable exception in the case of Gulf coast stations is to be noted. There was but little cloudiness on the southern slope and plateau.

*Average cloudiness and departures from the normal.*

| Districts.                   | Average. | Departure from the normal. | Districts.                 | Average. | Departure from the normal. |
|------------------------------|----------|----------------------------|----------------------------|----------|----------------------------|
| New England .....            | 5.9      | +0.4                       | Missouri Valley .....      | 5.8      | +1.9                       |
| Middle Atlantic .....        | 5.3      | +0.5                       | Northern Slope .....       | 4.8      | +0.6                       |
| South Atlantic .....         | 4.8      | +0.8                       | Middle Slope .....         | 3.7      | +0.6                       |
| Florida Peninsula .....      | 5.2      | +0.5                       | Southern Slope .....       | 2.2      | -0.6                       |
| East Gulf .....              | 3.1      | -0.5                       | Southern Plateau .....     | 1.4      | -0.6                       |
| West Gulf .....              | 3.0      | -0.6                       | Middle Plateau .....       | 4.2      | +1.0                       |
| Ohio Valley and Tennessee .. | 5.6      | +1.1                       | Northern Plateau .....     | 4.9      | +0.2                       |
| Lower Lake .....             | 6.8      | +1.0                       | North Pacific Coast .....  | 6.2      | +0.3                       |
| Upper Lake .....             | 7.4      | +1.3                       | Middle Pacific Coast ..... | 4.2      | +1.0                       |
| North Dakota .....           | 6.5      | +1.4                       | South Pacific Coast .....  | 2.4      | -0.6                       |
| Upper Mississippi Valley ..  | 6.5      | +2.1                       |                            |          |                            |

#### ATMOSPHERIC ELECTRICITY.

Numerical statistics relative to auroras and thunderstorms are given in Table IX, which shows the number of stations from which meteorological reports were received, and the number of such stations reporting thunderstorms (T) and auroras (A) in each State and on each day of the month, respectively.

*Thunderstorms.*—Six hundred and nineteen reports of thun-

derstorms were received during the current month as against 825 in 1897, and 2,696 during the preceding month.

The dates on which the number of reports of thunderstorms for the whole country were most numerous were: 9th, 78; 10th, 60; 16th, 59; 4th, 53.

Reports were most numerous from Missouri, 67; Louisiana, 53; Arkansas, 41; Texas, 40.

*Auroras.*—The evenings on which bright moonlight must have interfered with observations of faint auroras are assumed to be the four preceding and following the date of full moon, viz, 1st, 2d, 3d, and 24th to 31st.

The greatest number of reports were received for the following dates: 13th, 4; 7th, 8th, 20th, 21st and 28th, 3.

Reports were most numerous from Montana, 6; North Dakota, 5.

*In Canada.*—Auroras were reported as follows: Father Point, 7, 17, 28, 29; Quebec, 29; Minnedosa, 7; Qu'Appelle, 19, 20, 21; Banff, 19, 20; Prince Albert, 7, 21, 23; Barker-ville, 21.

Thunderstorms were reported as follows: Yarmouth, 30; Toronto, 4; Port Stanley, 4; Parry Sound, 3; Winnipeg, 1, 2; Minnedosa, 1, 2.

#### NOTES ON THE WEATHER OF THE WEST INDIES.

The following notes regarding the weather experienced in the West Indies will be of interest in connection with the climatological statistics at the end of Table I:

*San Juan, Puerto Rico.*—Observations at this station were begun on October 31. A very full and interesting report for November is expected.

*Santiago, Cuba.*—Owing to sickness of the regular observer, no mail reports were received from this station for October. Observations by the Juragua Iron Company, Limited, have been resumed at Firmeza, 16 miles east of Santiago and 5 miles inland from the Caribbean Sea. Copies will be furnished the Weather Bureau at an early date.

*Basseterre, St. Kitts.*—Although rain fell on eighteen days, but two thunderstorms were observed. The rains were rather evenly distributed throughout the twenty-four hours. Seven began between 6 a. m. and noon; 8 between noon and 6 p. m.; 7 between 6 p. m. and midnight, and 4 between midnight and 6 a. m.

*Roseau, Dominica.*—The observer arrived at this station on the 17th and the first observation was made at 6 a. m. of the 20th.

It is reported that the topography of Roseau and the immediate vicinity is not favorable to securing accurate records of the direction and force of winds from a northerly quarter.

*Bridgetown, Barbados.*—The observer makes frequent reference to the enervating effect of the weather at his station, due to the high temperature and humidity, the numerical values of which can be had from Table I.

There appears to have been a large number of night and early morning rains at this station. A count of the times that rain began gives the following results: Between 6 a. m. and noon, 7 times; noon and 6 p. m., 9 times; 6 p. m. and midnight, 8 times; midnight and 6 a. m., 13 times. A similar count for the remaining stations of the West Indian group does not show so great a preponderance of early morning rains. Thunderstorms occurred on the 4th, 14th, and 31st.

*Willemstad, Curaçao.*—The observer at Curaçao notes in his daily journal the fact that the mountains of Venezuela are visible on certain days. Eleven such dates were noted in his October journal. Rain was noted on 12 dates. The beginnings of rainfall were as follows: From 6 a. m. to noon, 8; noon to 6 p. m., 3; 6 p. m. to midnight, 2; midnight to 6 a. m., 4.

*Colon.*—The hour of the evening observation was changed